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Investigation Work Plan

for the

Passaic River Study Area

January 1995

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1.0 INTRODUCTION

This Investigation Work Plan (IWP) for Passaic River Study Area Activities has been prepared pursuant to Section VII, Paragraph 35.b of the Administrative Order on Consent Index No. II - CERCLA 94-0117 (AOC) in the matter of the Diamond Alkali Superfund Site (Passaic River Study Area). This IWP has been prepared in accordance with the requirements of Section B.3.a of Appendix I (Statement of Work) of the AOC.

The Passaic River Study Area is located on the lower portion of the Passaic River, which drains a 935 square mile watershed encompassing 117 municipalities in eight counties in northeastern New Jersey, and 15 municipalities and two counties in southern New York. The river, which is one of the major tributaries of Newark Bay, is located in the Greater New York City Metropolitan Area (Figure 1-1). The Passaic River Study Area is that portion of the Passaic River from the abandoned ConRail Railroad Bridge (located approximately 4000 feet upriver from the red channel junction marker at the confluence of the Hackensack and Passaic Rivers) to a transect six miles (31,680 feet) upriver of this bridge (Figure 1-2). The term Site shall mean the Passaic River Study Area.

As stated in Section IV, Paragraph 6 of the AOC, the bottom sediments of the Passaic River Study Area contain concentrations of numerous hazardous substances, including, but not limited to, cadmium, copper, lead, mercury, nickel, zinc, polyaromatic hydrocarbons (PAHs) bis(2-ethylhexyl) phthalate, polychlorinated biphenyls (PCBs), dichlorodiphenyl-trichloroethate (DDT), total extractable petroleum hydrocarbon (TEPH), 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD), 2,4-dichlorophenoxy acetic acid (2,4-D), 2,4,5-trichlorophenoxy acetic acid (2,4,5-T) and 2,4,5-trichlorophenol (2,4,5-TCP). Based upon Section VI set forth in the AOC, Occidental Chemical Corporation

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(OCC) is required to undertake a remedial investigation (RI)/feasibility study (FS) for the Site in accordance with the terms and provisions of the AOC.

This document is one of five plans comprising the Remedial Investigation Work Plan (RIWP). The RIWP consists of the following plans:

- Site Management Plan (SMP)
- Investigation Work Plan (IWP)
- Field Sampling Plan (FSP)
- Quality Assurance Project Plan (QAPP)
- Health and Safety/Contingency Plan (HASCP)

Specific terms and numerous acronyms are used throughout the RIWP. Table 1-1 is a list of acronyms that will be used throughout the RIWP.

Section 2.0 of this IWP describes the physical setting and history of the Site. Section 3.0 describes the three goals and corresponding objectives described in the SOW, while Sections 5.0, 6.0 and 7.0 describe the implementation of the work to be performed to achieve the goals. This document also presents an overview of the Graphical Representation of Data deliverable in Section 4.0, and in Section 8.0 provides an evaluation of the useability of historic bathymetric survey data for the Passaic River Study Area in meeting the chemical sampling and sediment mobility modeling requirements. Section 9.0 discusses the RI Report, while Section 10.0 provides a schedule for implementation of the RIWP. Section 11.0 provides references for the IWP.

TABLE 1-1

LIST OF ACRONYMS

The following is a list of acronyms used in the Investigation Work Plan, Field Sampling Plan, Quality Assurance Project Plan, Health and Safety/Contingency Plan, and Site Management Plan.

%D	percent difference
%R	percent recovery (of Spiked Samples)
%RSDs	percent relative standard deviations
^{137}Cs	cesium-137
^{210}Pb	lead-210
2,3,7,8-TCDD	2,3,7,8-tetrachloro-dibenzo-p-dioxin
2,4-D	2,4 Dichlorophenoxyacetic acid
2,4,5-T	2,4,5 Trichlorophenoxy acetic acid
2,4,5-TCP	2,4,5 Trichlorophenol
4-4'DDT	4-4' dichlorodiphenyltrichloroethane
^{7}Be	beryllium-7
ACGIH	American Conference of Governmental Industrial Hygienists
ADCP	Acoustic Doppler Current Profiler
AOC	Administrative Order on Consent, Index No. II - CERCLA-0117
ARARs	Applicable or Relevant and Appropriate Requirements
ASAP	As soon as possible
ASTM	American Society for Testing and Materials
BAZ	Biologically Active Zone
BZ	breathing zone
CA LUFT	California Leaking Underground Fuel Tank
CAD	Computer Aided Drafting
CCV	Continuing Calibration Verification
CDI	chronic daily intake

TABLE 1-1

LIST OF ACRONYMS
(Continued)

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHP	Chemical Hygiene Plan
CLP	Contract Laboratory Program
C/M	counts per minute
COCs	chemicals of concern
CPCs	chemicals of potential concern
CPM	Contractor Project Manager
CPR	cardiopulmonary resuscitation
CRDL	Contract Required Detection Limit
CS3	Calibration Standard 3
CSFs	cancer slope factors
CSOs	Combined Sewer Outfalls
CV	cold vapor atomic absorption
CVAA	cold vapor atomic absorption
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenoldichloroethene
DDT	dichlorodiphenyl-trichloroethate
DL	detection limit
DO	dissolved oxygen
DOT	Department of Transportation
EA	Engineering, Science, and Technology, Inc.
ECAO	Environmental Criteria and Assessment Office
EDL	Estimated Detection Limit
EDM	electronic distance measurement
EMPC	Estimated Maximum Possible Concentration
EPA	U.S. Environmental Protection Agency

TABLE 1-1

LIST OF ACRONYMS
(Continued)

EQ	ecotoxicological quotient
ESP	Ecological Sampling Plan
FID	flame ionization detector
FS	Feasibility Study
FSP	Field Sampling Plan
FSWP	Feasibility Study Work Plan
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
GFAA	graphite furnace atomic absorption
GIS	Geographic Information System
GPS	Global Positioning System
HASCP	Health and Safety/Contingency Plan
HEAST	Health Effects Assessment Summary Tables
HEPA	High Efficiency Particulate Air
HERA	Human and Ecological Risk Assessment
HRGC	high resolution gas chromatography
HRMS	high resolution mass spectroscopy
HSM	Health and Safety Manager
HSO	Health and Safety Officer
ICP	inductively coupled plasma emission spectroscopy
ICV	Initial Calibration Verification
IDL	instrument detection limit
IRIS	Integrated Risk Information Service
IRP	initial precision and accuracy
ISC	Interstate Sanitation Commission
IWP	Investigation Work Plan
J	estimated value

TABLE 1-1

LIST OF ACRONYMS
(Continued)

JH	estimated maximum value
JL	estimated minimum value
LCS	Laboratory Control Sample
LOAEL	Lowest Observable Adverse Effects Level
Maxus	Maxus Corporate Company, a subsidiary of Maxus Energy Corporation
MDL	Method Detection Limit
MLW	Mean Low Water
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MS/Duplicate	Matrix Spike and Laboratory Duplicate
MSA	Method of Standard Additions
NAS	National Academy of Sciences
NCDI	noncancer chronic daily intake
NCP	National Contingency Plan
NEIC	National Enforcement Investigation Center
NGVD	National Geodetic Vertical Datum
N.J.	New Jersey
NJ	analyte tentatively identified at estimated concentration (QAPP)
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observable Adverse Effects Level
NPDES	National Pollutant Discharge Elimination System
NY	New York
O&M	Operating and Maintenance
OCC	Occidental Chemical Corporation and its representatives

TABLE 1-1

LIST OF ACRONYMS
(Continued)

OCDD	octachlori-dibenzodioxin
OCDF	octachloro-dibenzofuran
OD	outer diameter
OPR	ongoing precision and accuracy
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCDDs	polychlorinated dibenzo-p-dioxins
PCDFs	polychlorinated dibenzofurans
PEL-TWA	Permissible Exposure Limit - Time Weighted Average
PM	Project Manager
POTW	Publicly Owned Treatment Works
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
ppt	part per trillion
PQL	Practical Quantitation Limit
PRD	Passaic River Division of the USACE
PRP	Potential Responsible Party
PSE&G	Public Service Electric and Gas Company
PVC	polyvinyl chloride
PVSC	Passaic Valley Sewerage Commission
QA	quality assurance
QA/QC	quality assurance/quality control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan

TABLE 1-1

**LIST OF ACRONYMS
(Continued)**

QC	quality control
QSAR	quantitative structure activity relationship
'R'	rejected sample results
RAOs	Remedial Action Objectives
RfDs	reference doses
RHSO	Regional Health and Safety Officer
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
RME	reasonable maximum exposure
RPD	Relative Percent Difference (of Duplicate Samples)
RQL	Required Quantitation Limit
RRF	Relative Response Factor
RSD	Relative Standard Deviation
SAP	Sampling Analysis Plan
SCBA	Self Contained Breathing Apparatus
S/N	signal to noise ratio
SDG	Sample Delivery Group
SICPs	Selected Ion Current Profiles
SIM	Selected Ion Monitoring
Site	Passaic River Study Area
SMCs	System Monitoring Compounds/Surrogates
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Statement of Work, Appendix I to the AOC
SQL	Sample Quantitation Limit
SSO	Site Safety Officer

TABLE 1-1

LIST OF ACRONYMS
(Concluded)

STUDH	Sediment Transport in Unsteady, 2-Dimensional Flow, Horizontal Plane
SW-846	Test Methods for Evaluating Solid Waste, SW-846
TAL	Target Analyte List (for Metals)
TBC	to be considered
TCL	Target Compound List (for Organic Compounds)
TD	total depth
TDS	Total Dissolved Solids
TEPH	Total Extractable Petroleum Hydrocarbons
TLV-TWA	Threshold Limit Value - Time Weighted Average
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TWA	Time Weighted Average
'U'	non-detect (QAPP)
'UJ'	estimated non-detect (QAPP)
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VER	Calibration Verification Solution
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Temperature Index
WES	Waterways Experiment Station


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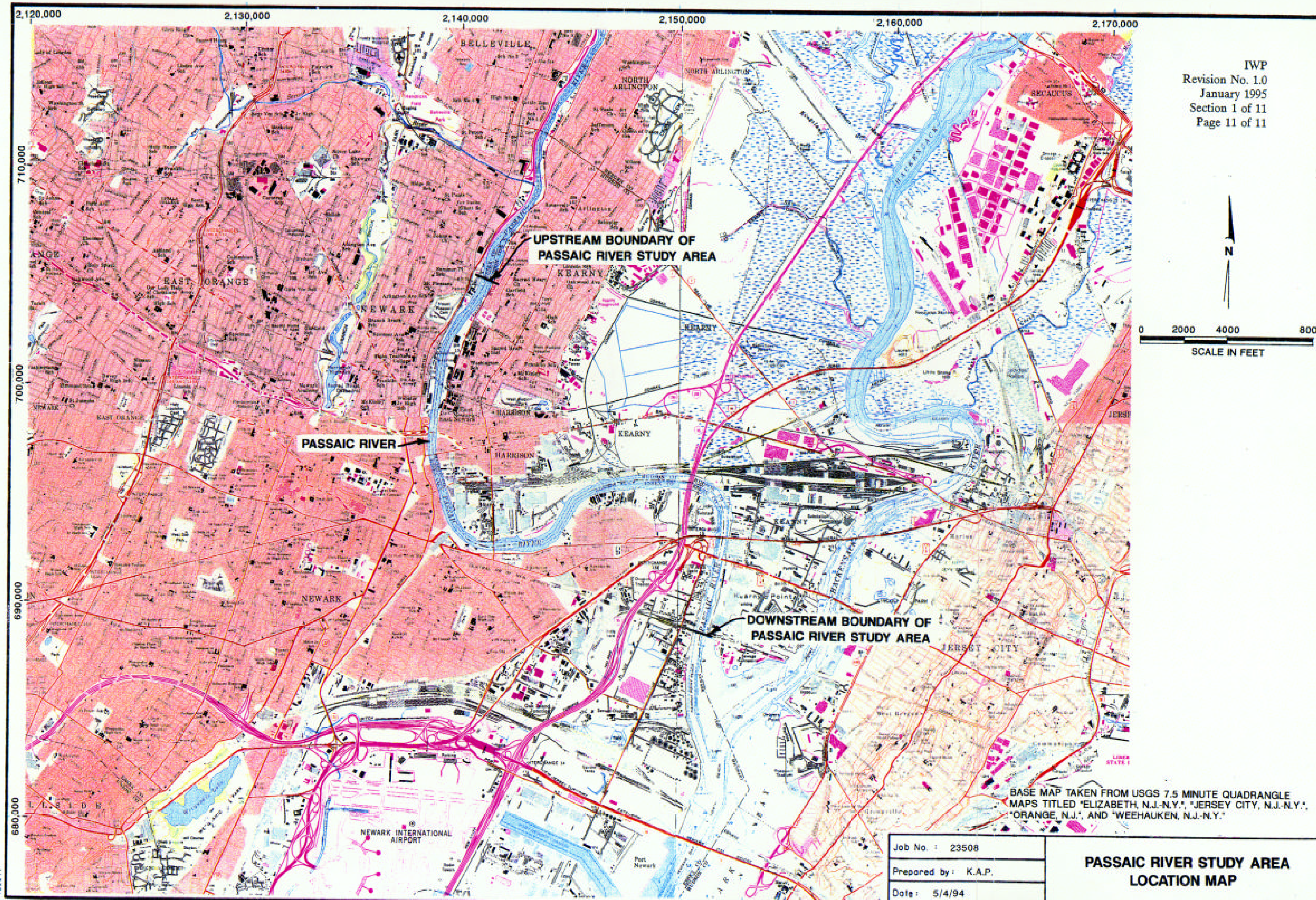
PASSAIC RIVER
HACKENSACK RIVER
MANHATTAN
QUEENS
UPPER BAY
Newark
Jersey City
Bayonne
Elizabeth
Paterson
Kearny
Hoboken
BASE MAP TAKEN FROM RAND McNALLY ROAD ATLAS DATED 1989.
N
0 1 2
MILES
Job No. : 23508
Prepared by : K.A.P.
Date : 5/11/94
GREATER NEW YORK CITY
METROPOLITAN AREA
REGIONAL MAP

FIG. 1-1



Job No. : 23508	PASSAIC RIVER STUDY AREA LOCATION MAP
Prepared by: K.A.P.	
Date: 5/4/94	

FIG. 1-2

2.0
PHYSICAL SETTING/SITE HISTORY

This section describes the physical setting of the Passaic River Study Area and the history of the Site. For the purposes of this RI, the shoreline of the Passaic River will be defined as left and right shorelines as looking upstream, and Station 0+00 of the Passaic River Study Area corresponds to the downstream boundary of the Site located approximately at United States Army Corps of Engineers (USACE) station designation 40+00.

2.1 PHYSICAL SETTING

2.1.1 Geologic Setting

The Site is situated within the Newark Basin portion of the Piedmont physiographic province. The province is located between the Atlantic Coastal Province and the Appalachian Province. The Newark Basin is underlain by sedimentary rocks (sandstones, shales, limy shales, and conglomerates), igneous rocks (basalt and diabase) and metamorphic rocks (schists and gneiss). These rocks are from the mid-Triassic to early Jurassic periods. Bedrock underlying the Site is the Passaic Formation (Olsen et al. 1984; Nichols 1968), which consists of interbedded red-brown sandstones and shales.

Almost the entire Passaic River Basin, including the Site, was subjected to glacial erosion and deposition as a result of the last stage of the Wisconsin glaciation. Considerable quantities of stratified sand, silt, gravel and clay were deposited in a glacial lake covering the area. These glaciofluvial deposits overlie bedrock and underlie the meadowlands section of the Newark Basin.

2.1.2 Surface Water Hydrology

Based on data from the United States Geological Survey (USGS) (1989) and provided in USACE (1987), the upstream Passaic River contributes the majority of freshwater inflow (approximately 1,200 cubic feet per second on average) to the lower portion of the river, which includes the Site (Figure 2-1). The Third River, a tributary which discharges to the Passaic River approximately three and one half miles upstream of the Site, contributes, on average, an additional 21 cfs (cubic feet per second). Additional freshwater inflow can also come from three ungaged tributaries located downstream of the Third River, namely the Second River, Franks Creek, and Lawyers Creek, and from urban runoff, including storm sewers and combined sewer outfalls (CSOs). According to Suszkowski (1978), the ungaged flow between Dundee Dam and Newark Bay is less than 10% of the total flow at the mouth of the Passaic River. Pollutant loadings that are associated with this additional inflow are considered significant for some chemicals (Killam Associates, Inc. 1976). The lower Passaic River, including the Site, is considered to have serious water quality problems (USACE 1987). The water quality is rated very poor in both the freshwater regime above the Dundee Dam, and below the dam in the saline tidal reach (USACE 1987).

The lower Passaic River, including the Site, is influenced by tidal flows for approximately 17 miles, extending from Dundee Dam downstream to the confluence with Newark Bay. The mean tidal range (difference in height between mean high water and mean low water) at the New Jersey Turnpike Bridge (approximately 1.5 miles upstream from Newark Bay) is 5.1 feet (NOAA 1972) with a mean tide level (midway between mean low water and mean high water) at elevation 2.5 feet (NOAA 1972). The mean spring tide range (average semi-diurnal range occurring during the full and new moon periods) is 6.1 feet. Saline water conditions exist throughout the Site. The cross-sectional average river velocity due to freshwater flow in the Site is approximately 1 foot per second and a typical maximum tidal velocity of approximately is 3 feet per second

(USACE 1987). The velocities resulting from upstream freshwater flow conditions will not normally control the resuspension of bottom sediments (USACE 1987).

The Site is situated within five USACE defined navigation reaches, including Point No Point Reach, Harrison Reach, Newark Reach, Kearny Reach, and Arlington Reach (Figure 2-2). The Site is considered navigable by USACE (1987).

2.1.3 Climate

The information provided by USACE (1987) indicate that the climate for the Site and surrounding area is characteristic of the Middle Atlantic Seaboard, where marked changes in weather are frequent, particularly in the spring and fall. Winters are moderate with snowfall averaging approximately 34 inches annually from October through mid-April. Rainfall is moderate and distributed fairly uniformly throughout the year, averaging approximately 47 inches annually with an average of 121 rainy days per year, although the region may be influenced by seasonal tropical storms and hurricanes between June and November. Thunderstorm activity is most likely to occur in the summer, and northeasters from November to April. The average annual temperature in Newark is 54 degrees Fahrenheit (F); with extremes from -26 degrees F to +108 degrees F. Mean relative humidity varies from 67% to 73%. Prevailing winds in the Newark area are from the southwest, with only small seasonal variations in direction. The mean wind direction for the winter months is west-northwest (13 percent of the time), while southwest winds (12 percent of the time) predominate during the summer. Mean wind speeds are generally highest during the winter and spring months (10 to 12 miles per hour), and lower (8 to 9 miles per hour) during the summer months, with an average annual velocity of approximately 10 miles per hour.

2.1.4 Land Use & Demographics

The Site has a long history of industrialization, dating back more than two centuries (Meyers 1945; Cunningham 1966a, 1966b; Brydon 1974). By 1850, Newark had a number of chemical companies producing a diverse range of chemical products and raw materials (Cunningham 1954; Zdepski 1992). By the turn of the century, Newark was the largest industrial-based city in the United States with well established industries such as petroleum refining, shipping, tanneries, creosote wood preservers, metal recyclers, and manufacturing of materials such as rubber, rope, textiles, paints and dyes, pharmaceutical, raw chemicals, leather, and paper products (Meyers 1945; Cunningham 1954; Cunningham 1966a; Brydon 1974; Halle 1984; MacRae's 1986; Galishoff 1988). Both World War I and World War II promoted further urban and industrial growth in the region (Squires 1981). Waterborne commerce also greatly expanded during the period between 1920 and 1950 (Squires 1981).

Land use along the lower Passaic River, extending south of the Dundee Dam and including the Site, is dominated by high-density commercial and industrial/commercial development. Almost all of the wetlands in the lower Passaic River have been eliminated, with more than 7,500 acres developed since 1940 (USACE 1987). The left bank of the Site (looking upstream) is almost fully developed, consisting of active or abandoned commercial and industrial/commercial properties with little or no access to the river. Active or abandoned industrial properties and rail lines completely dominate the right bank (looking upstream) of the Site for approximately five miles from the confluence with Newark Bay. The final mile is a mixture of industrial and commercial properties. A highly developed network of highways, CSOs, stormwater outfalls, and publicly owned treatment works (POTWs) exists throughout the area (Mueller et al. 1982).

2.1.5 Shoreline Features

Both shorelines of the Passaic River Study Area are almost completely developed, consisting of commercial and industrial properties. For the purposes of descriptions in this RIWP, the shoreline of the Passaic River will be defined as left and right shorelines as looking upstream. The thalweg of the river is generally in the center of the channel in straight sections and is observed to favor the outside bends of the meanders as expected. The Passaic River Study Area encompasses four complete and one partial USACE defined navigation reaches; the Point No Point, the Harrison, the Newark, the Kearny, and the Arlington Reaches. The Arlington Reach reflects the partial reach. For reference, Station 0+00 of the Passaic River Study Area corresponds approximately to USACE station designation 40+00 and Station 216+80 of the Passaic River Study Area corresponds approximately to USACE station designation 256+80.

Point No Point Reach

The Point No Point Reach, extends from the downstream river boundary (Station 0+00) to approximately Station 67+00 of the Passaic River Study Area (Figure 2-3). The Reach follows a north-south trend and is the deepest portion of the Passaic River Study Area. The only major natural inflow to the Reach is Lawyer's Creek, a small drainage that enters from the left bank approximately 3,000 feet from the upstream end of the Reach. The Reach contains three bridges including the abandoned Conrail Bridge that delineates the lower portion of the Passaic River Study Area, and the Lincoln Highway and the General Pulaski Skyway Bridges (U.S. Routes 1&9).

The USACE is responsible for delineating and maintaining navigation channels in the Passaic River. The Federal Project Limit (the extent of the channel to be maintained in the river) was originally adopted in 1907 and modified in 1911, 1912, 1930, and provides for a channel 30 feet deep (relative to MLW) and 300 feet wide in the Point No Point Reach (pers. com. John Bianco USACE-PRD).

The USACE last performed a hydrographic survey in 1989 to assess the conditions of the river. Water depths in the Point No Point Reach ranged from approximately 33.0 feet (MLW) at the downstream end to 21.1 feet (MLW) at the upstream end. The channel in the Point No Point Reach was last dredged in 1983 to the Project Depth of 30 feet. Previous dredgings in the period of interest (1940 to present) are reported in 1971, 1965, 1957, 1946, and 1940 (IT 1986).

The shorelines of the Reach consist primarily of wooden and stone bulkheads and are bordered by several industrial facilities. The right shoreline contains several large industrial facilities including Western Electric, BASF, SpectraServe and a former Monsanto manufacturing plant. The left shoreline consists of mostly wooden bulkheads and contains ship piers, several chemical and petro-chemical manufacturing facilities (including Reichold Chemical, Sun Oil, Hoescht-Celanese), and the former Public Service Electric and Gas Company's (PSE&G) Essex Generating Station.

The Point No Point Reach contains one CSO. It is located on the left bank, at approximately Station 13+00 and for nomenclature purposes has been called Un-named 3. The CSO is one of four that drains the Newark CSO District.

Harrison Reach

The Harrison Reach extends from approximately Station 67+00 to Station 181+00 of the Passaic River Study Area (Figure 2-4). The Reach begins with a relatively straight section running east-west before entering a large meander near the end of the Reach. Frank's Creek enters the Reach from the right bank at approximately Station 120+00. Based on the hydrographic survey conducted by USACE in 1989, water depths in the

Reach ranged in depth from 21.1 feet (MLW) at the downstream end of the Reach to approximately 19.2 feet (MLW) at the upstream end. There appear to be areas of higher deposition on the inside bends of the meanders.

There are two bridges in the Harrison Reach, close together near the downstream end of the reach. Looking upstream, the first bridge is a ConRail (Penn Central) freight bridge and the second is the bridge for Interstate 95 (New Jersey Turnpike).

The USACE has delineated the Project Limits for the Reach as a 300 foot wide channel with a Project Depth of 20 feet (MLW). The only dredging event in the Harrison Reach within the period of interest (1940 to present) was performed in 1949. The dredging at that time was to the Project Depth of 20 feet.

The right shoreline consists primarily of gravel rip-rap and wooden or stone bulkheads bordered by a passenger train yard and a train servicing depot; the left shoreline consists of wooden bulkheads bordered by several chemical facilities (e.g., Benjamin Moore, Chemical Waste Management, Hilton-Davis, Sherwin-Williams) and inactive industrial properties (including Commercial Solvents, Diamond Shamrock). An abandoned marina is located at Blanchard Street between the abandoned Commercial Solvents site and the Benjamin Moore facility.

The Harrison Reach contains a total of six direct and three indirect CSO discharges into the Passaic River. The following direct CSOs drain the Newark CSO district in upstream order: Un-named 2 located at Station 95+00; Un-named 1 located at Station 106+00; Newark located at Station 122+00. The Worthington Avenue CSO is located at Station 141+00 on the right bank; the Freeman Street CSO is located at Station 159+00 and the Polk Street CSO is located at Station 176+00. All direct CSOs with the exception of Worthington Avenue are on the left bank. The three indirect CSO discharges are located on Franks Creek upstream from the confluence with the Passaic

River. The three CSOs drain the Bergen Avenue, Tappan Street, and Dukes Street CSO districts.

Newark Reach

The Newark Reach extends from Station 181+00 to Station 258+00 of the Passaic River Study Area and runs through the downtown section of the City of Newark (Figure 2-5). This Reach of the Passaic River begins in an east-west direction and slowly curves in a northerly direction.

The Newark Reach contains numerous bridges. Looking upstream the bridges include: the Jackson Street Bridge, the Amtrak Railroad Bridge, the Harrison Ave. Bridge, a Conrail freight railroad bridge, the William Stickel Memorial Bridge, and the Clay St. Bridge which delineates the upstream extent of the Newark Reach. The Center St. Bridge was located between the Amtrak and Harrison Avenue Bridges, however, this bridge has since been abandoned and the bridge piers removed.

The USACE has designated the Project Limits as 300 feet wide in the Newark Reach with a Project Depth of 20 feet (MLW). The only dredging within the period of interest (1940 to present) was performed in 1949. The dredging at that time was to a project depth of 16 feet. The last hydrographic survey was performed in 1989. Based on the 1989 survey, channel depths in this reach range from 19.2 feet (MLW) at the downstream end to 18.7 feet (MLW) at the upstream end.

The right shoreline consists of wooden, metal, or stone bulkheads bordered by oil storage tanks and numerous small manufacturing facilities and a former coal burning facility near the Jackson St. Bridge. The left shoreline consists of wooden and stone bulkheads bordered by a small park along side Highway 52 (fenced on the river side), and parking lots.

The Newark Reach contains a total of eleven direct CSOs discharging into the Passaic River. In upstream order, the CSOs are: the Jackson Street CSO on the left bank at Station 183+00; the City Dock CSO on the left bank at Station 200+00; the Saybrook Place CSO on the left bank at 217+00; the Middlesex Street CSO on the right bank at Station 219+00; the Rector Place CSO on the left bank at Station 224+00; the Bergen Street CSO on the right bank at Station 226+00; the Dey St CSO on the right bank at Station 230+00; the Bridge Street and Harrison Avenue CSOs on the left and right bank respectively, both at Station 235+00; the Orange Street and Cleveland Avenue CSOs on the left and right bank respectively both at Station 240+00; and the New Street CSO on the right bank at Station 245+00.

Kearny Reach

The Kearny Reach extends from approximately Station 258+00 to 310+00 in the Passaic River Study Area (Figure 2-6). The Reach begins in a general north-south direction and then curves to the northeast. The Reach contains two bridges; the aforementioned Clay St. Bridge that delineates the boundary between the Newark and Kearny Reaches and a former Erie & Lackawanna Railroad bridge. The railroad bridge is abandoned and maintained in the open position.

The USACE has designated the Project Limits for the Kearny Reach as 300 feet wide with a Project Depth of 20 feet. The only dredging in the period of interest (1940 to present) was performed in 1949 to a then Project Depth of 16 feet. Based on the 1989 hydrographic survey, channel depths range from 18.7 feet (MLW) at the downstream end of the Reach to 17.0 feet (MLW) at the upstream end.

The left shoreline consists primarily of stone bulkheads and is bordered by train tracks serviced by ConRail and 4-lane Highway 22 (McCarter Freeway) leading northward from downtown Newark. The ConRail rail lines end at the site of the former PPG manufacturing plant located along the left shore of Kearny Reach. The right shore of the Kearny Reach consists of wooden and stone bulkheads bordered by several small manufacturing facilities.

The Kearny Reach contains a total of six CSOs discharging into the Passaic River. The Clay Street and Central Avenue CSO are on the left and right bank respectively at Station 259+00; the Passaic Street CSO is on the left bank at Station 265+00; the Johnston Avenue CSO is on the right bank at Station 271+00; the Fourth Ave CSO is on the left bank at Station 279+00; the Oriental Street CSO is on the left bank at Station 285+00; the Nairn Avenue CSO is on the right bank at Station 289+00; and the Bergen Street CSO discharges from the right bank at Station 306+00.

Arlington Reach

Only a small portion of the Arlington Reach is in the Passaic River Study Area. The Arlington Reach extends from Station 310+00 beyond the upstream extent of the Passaic River Study Area at Station 316+80 (Figure 2-7). The river direction does not change appreciably in the Arlington Reach.

The USACE has delineated the Project Limits as 200 feet wide in the Arlington Reach with a Project Depth of 16 feet (MLW). The dredging of this Reach in the period of interest occurred in 1949 and was completed to the Project a Depth of 16 feet (MLW). Based on the 1989 hydrographic survey, the channel depth in the Passaic River Study Area portion of the Reach is 17.0 feet (MLW).

The right shoreline of the Arlington Reach consists of wooden and stone bulkheads bordered by several small manufacturing facilities and some private homes at the northern end of the Passaic River Study Area. The left shore of the Arlington Reach consists primarily of parking lots.

The Passaic River Study Area within the Arlington Reach contains only one CSO. The Herbert Avenue CSO discharges into the river from the right bank at Station 315+00. There are two other CSOs that are serviced by the Passaic Valley Sewerage Commission (PVSC) that discharge into the Passaic River upstream from the Passaic River Study Area but whose discharge may influence material within the Study Area the Delavan Avenue and Verona Avenue CSOs.

2.2 SITE HISTORY

2.2.1 History of Contamination

During the past two centuries, the Site has been subject to multiple influences and changes due to natural hydrological, topographical, climatological and ecological conditions. However, of greater significance were changes due to rapidly expanding urban and industrial development in the region. Available information indicates that historical pollutant loadings throughout the 1900s have had a substantial impact on the ecological conditions of the Site, as well as the Newark Bay estuary (McCormick and Quinn 1975; Earll 1887; Mytelka et al. 1981; Esser 1982; Squires 1981; and Hurley 1992).

Degradation of water quality in the lower Passaic River, including the Site, first became apparent during the Civil War (Brydon 1974; Cunningham 1966b). In 1873, coal tar residues suspended in the river water were noted (Brydon 1974). The deteriorating water quality of the lower Passaic River during this period forced many residents to dig their own wells; by 1885 however, a survey showed that seventy-five percent of groundwater wells also were polluted (Cunningham 1966b). Between 1884 and 1890, over 1,000 of Newark's more than 1,500 wells had been closed due to contamination (Galishoff 1988). In 1887, an inspector for the Passaic River declared that legal action would be required to mitigate pollution of the river from industrial waste practices (Brydon 1974). In 1894, as much as one third of the total flow of the Passaic River was estimated to be sewage (Brydon 1974). In 1910, the mouth of the Passaic River was declared to be black from the sewage and manufacturing wastes it receives" (Mytelka et al. 1981).

The growing population of Newark during the first half of the twentieth century resulted in the generation of increasing volumes of human wastes, resulting in a characterization of the lower Passaic River as an open sewer (Suszkowski et al. 1990). Efforts to improve the water quality and to reduce the spread of disease of the Passaic River led to the construction of a trunk sewer line system in 1924 (Brydon 1974). In addition, despite the development of sewage treatment plants, many industrial facilities located along the Passaic River were not connected to the Passaic Valley Sewage Commission trunk line until the late 1950s (Brydon 1974).

During the 1980s and early 1990s, several investigations were conducted to evaluate the concentrations of various potential contaminants in sediments within the Site boundaries. These studies include investigations conducted as part of the remedial investigation work at the Diamond Alkali Superfund Site, investigations conducted on behalf of OCC in the early 1990s, and investigations conducted by various governmental agencies including National Oceanic and Atmospheric Administration (NOAA), the US Fish and Wildlife Service (USFWS), and EPA. These investigations indicated that sediments of the Passaic River Study Area contain elevated concentrations of numerous hazardous substances including, but not limited to, cadmium, copper, lead, mercury, nickel, zinc, bis(2-ethylhexyl)phthalate, polynucleararomatic hydrocarbons, polychlorinated biphenyls (PCBs), 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), diesel range organics (Total Extractable Petroleum Hydrocarbons), polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, and chlorinated herbicides and phenols (Huntley, 1993; Bonnevie, 1993; Gillis, 1993; Wenning, 1993; Bonnevie, 1992; Bonnevie, 1994; Wenning, 1994).

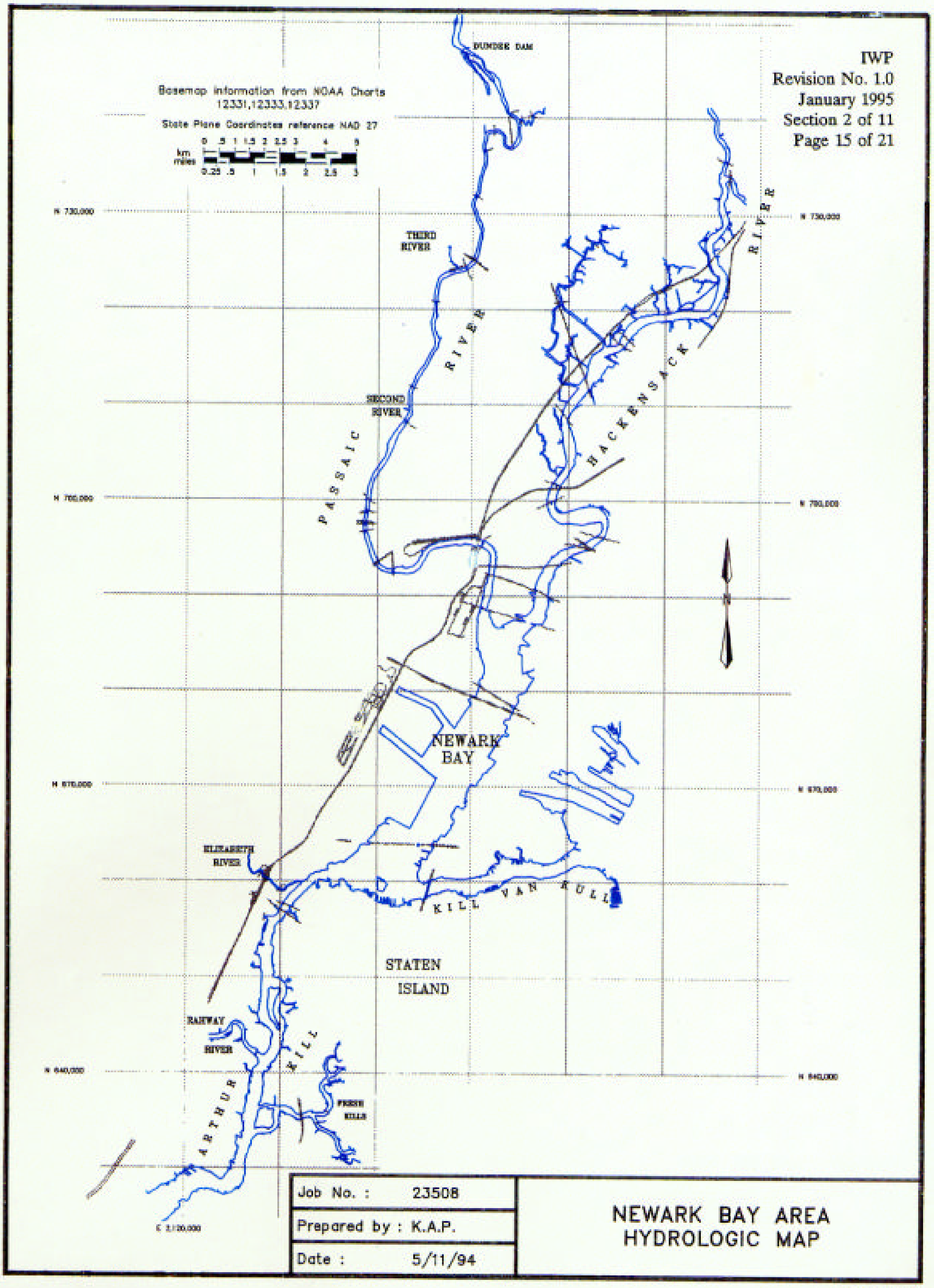
2.2.2 History of Ecology

The expansion of industry and population surrounding the Site has resulted in a severe reduction in the availability of natural habitats for indigenous and migratory biota (Squires and Barclay 1990). Much of the city of Newark occupies land once dominated by salt marsh, which was filled with more than 21 million tons of material, including industrial and municipal wastes, dredge spoils, and railroad cinders (Zdepski 1992). The left shore of the Site, just upstream of the New Jersey Turnpike Bridge was once primarily marshlands (ERM 1992). Between 1873 and 1890, this area was extensively filled with 8 to 12 feet of mixed fill material from coal-gasification facilities, eliminating the marsh habitat and introducing a wide variety of chemicals to the environment (ERM 1992). By the early 1900s, the majority of salt marshes were filled with solid waste and pesticide application was routine in an effort to eliminate mosquito breeding areas (Zdepski 1992; Rod et al. 1989). A decline in bird diversity in the area is attributed to the destruction of marshlands and other natural habitats as a result of encroachment of human development and industrial activities on nesting and breeding grounds (Burger et al. 1993).

Populations of fish and shellfish in the Site and surrounding area have been substantially reduced by over-harvesting, loss of habitat, and pollution (Mytelka et al. 1981; Esser 1982; Franz 1982). A significant commercial fishery has not operated in Newark Bay or the Passaic River, including the Site, since the early 1900s (McCormick and Quinn 1975). As early as the Civil War, sales of oysters and shad were affected by reports that the organisms were tainted with coal oil and "off flavors" (Earll 1887; Squires 1981). The Commission of Fisheries of New Jersey reported in 1885 that water-borne pollution was resulting in declining fish populations in the Passaic River (Esser 1982). After the turn of the century, conditions apparently deteriorated rapidly until 1926, when a survey conducted in the area by the US War Department found “fish life destroyed” (Hurley 1992).

Based on the results of monitoring and research undertaken since the mid-1970s, the State of New Jersey has taken a number of steps, in the form of consumption advisories, closures, and sales bans, to limit the exposure of the fish-eating public to toxic contaminants in the Passaic River Study Area. The initial measures prohibited the sale, and advised against the consumption, of several species of fish and eel and was based on the presence of PCB contamination in the seafood. The discovery of widespread dioxin contamination in the Newark Bay Complex led the State of New Jersey to issue a number of Administrative Orders in 1983 and 1984 which prohibited the sale or consumption of all fish, shellfish, and crustaceans from portions of the Passaic River including the Passaic River Study Area. These State fish advisories and prohibitions are still in effect.

Recent studies of the lower Passaic River and Site report the presence of some fish and benthos known to be highly tolerant of reduced dissolved oxygen conditions, implying the presence of a stressed aquatic system (Festa and Toth 1976; Santoro et al. 1980; Princeton Aqua Science 1982). Depressed levels of dissolved oxygen have been known to be a chronic problem in Newark Bay and its tributaries since the early 1900s (McCormick et al. 1983). Investigations conducted prior to 1940 by the Interstate Sanitation Commission (ISC) indicated substantially decreased levels of dissolved oxygen (DO) throughout the region during the early part of the century (ISC 1939). A survey of benthic organisms conducted in the Site in 1981 indicated that the benthic macroinvertebrate community was limited to those species capable of surviving extremely poor water quality conditions (Princeton Aqua Science 1982). Available studies of sediment and water quality indicate that pollution control measures and the reduction or control of other environmental stressors have produced a gradual improvement in the ecosystem over the past two decades.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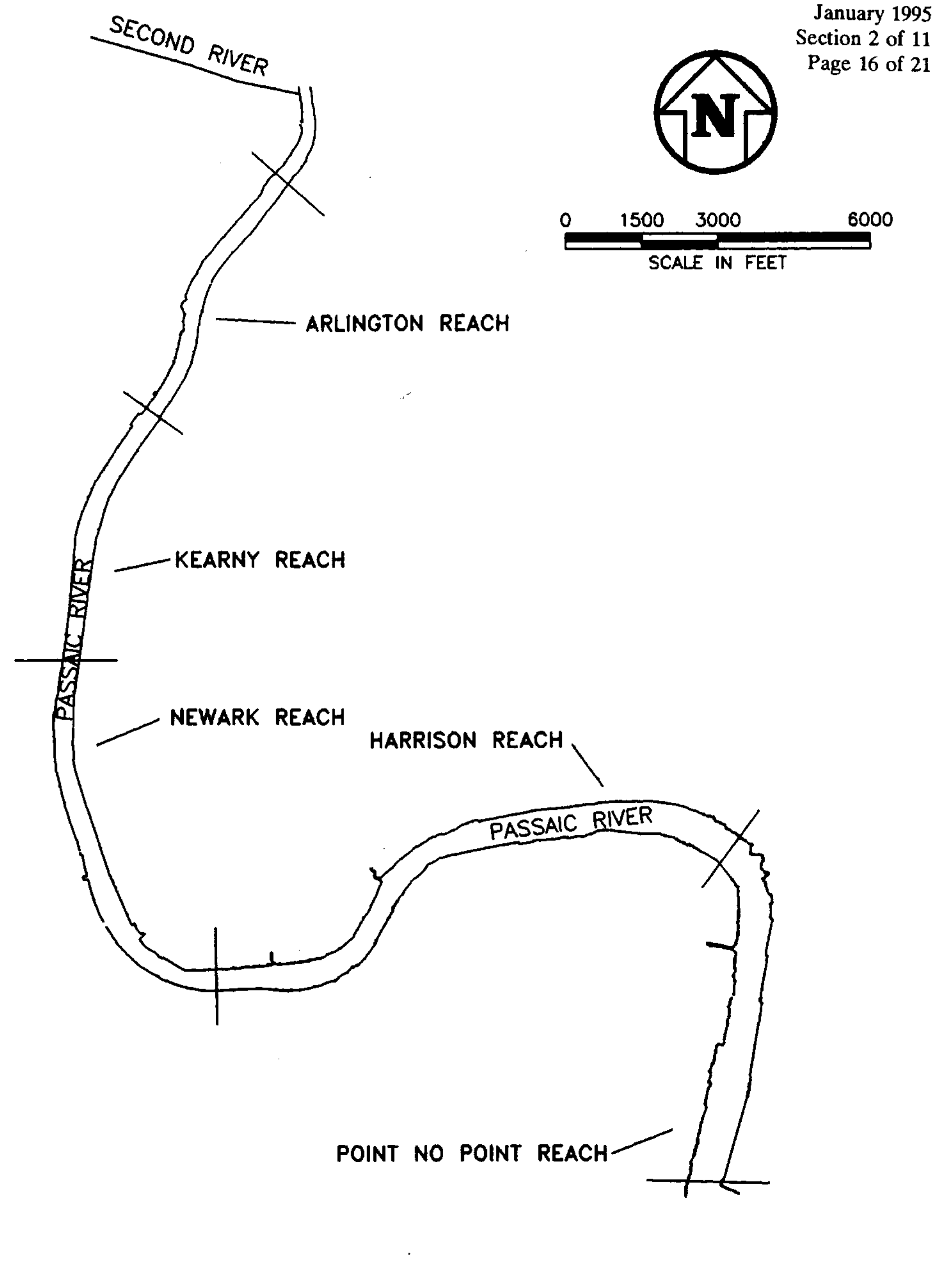
Basemap information from NOAA Charts
12331,12333,12337
State Plane Coordinates reference NAD 27
km
miles
DUNDEE DAM
THIRD RIVER
SECOND RIVER
PASSAIC RIVER
HACKENSACK RIVER
NEWARK BAY
ELIZABETH RIVER
KILL VAN KULL
STATEN ISLAND
RAHWAY RIVER
ARTHUR KILL
FRESH KILLS
N 730,000
N 700,000
N 670,000
N 640,000
Job No. : 23508
Prepared by : K.A.P.
Date : 5/11/94
NEWARK BAY AREA
HYDROLOGIC MAP

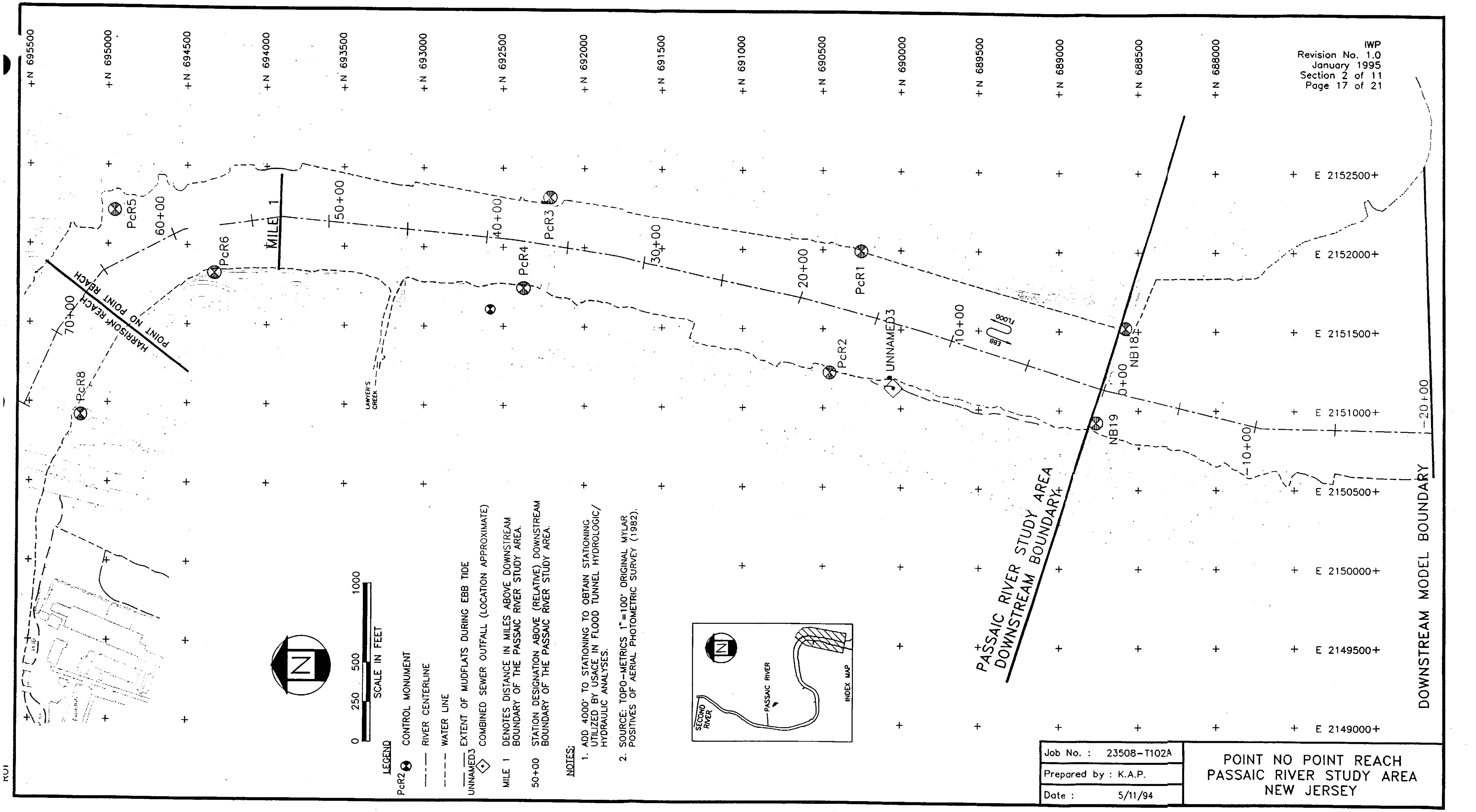
FIG. 2–1



Job No. : 23508	REACHES OF THE PASSAIC RIVER STUDY AREA
Prepared by : K.A.P.	
Date : 5/10/94	

REACHES1

FIG. 2-2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+N 695500
+N 695000
+N 694500
+N 694000
+N 693500
+N 693000
+N 692500
+N 692000
+N 691500
+N 691000
+N 690500
+N 690000
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+N 689000
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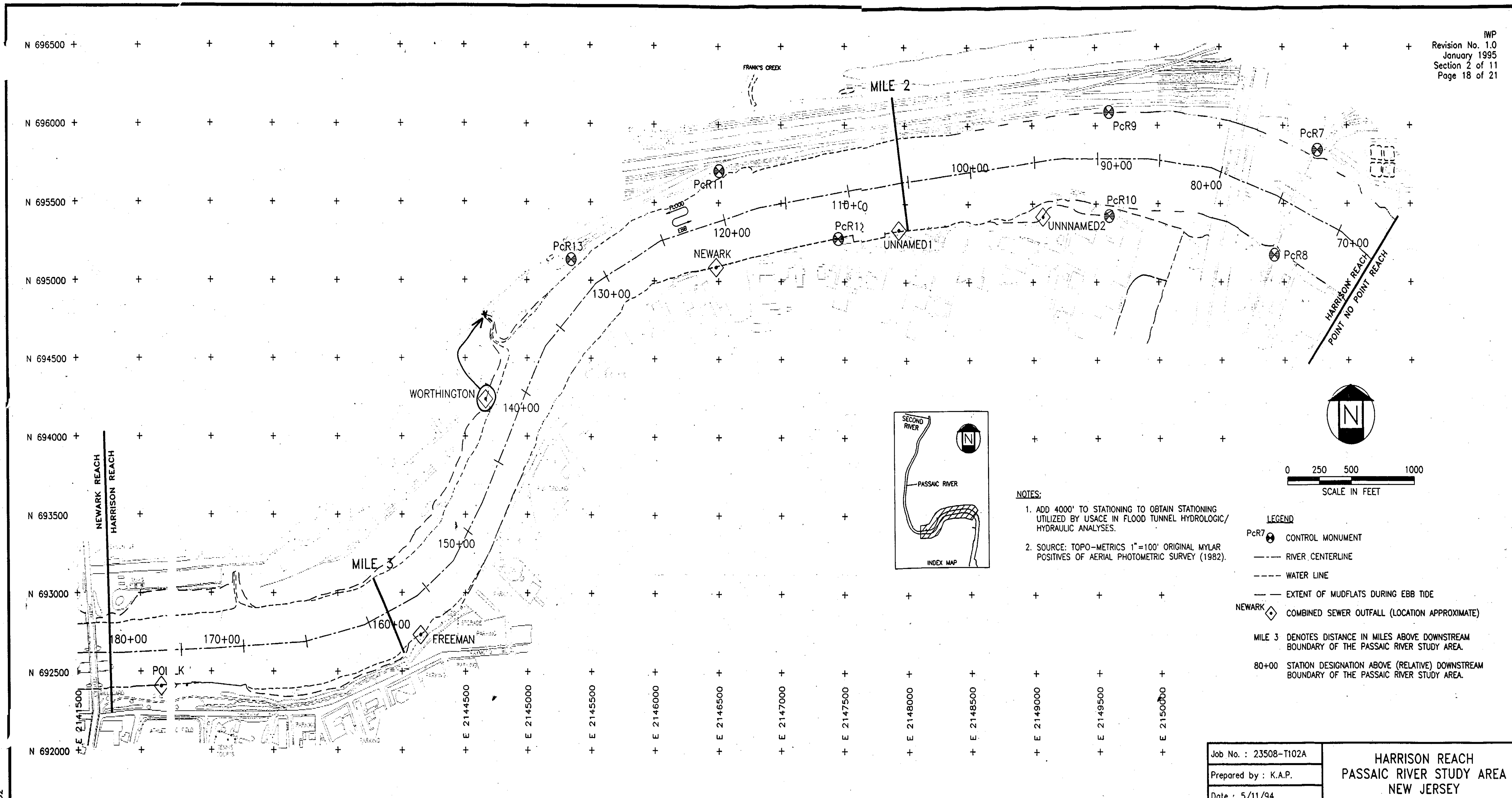
E 2152500+
E 2152000+
E 2151500+
E 2151000+
E 2150500+
E 2150000+
E 2149500+
E 2149000+
PcR1
PcR2
PcR3
PcR4
PcR5
PcR6
PcR8
NB18
NB19
UNNAMED3
MILE 1
70+00
60+00
50+00
40+00
30+00
20+00
10+00
0+00
-10+00
-20+00
FLOOD
EBB
LAWYER'S CREEK
POINT NO POINT REACH
HARRISON REACH
PASSAIC RIVER STUDY AREA
DOWNSTREAM BOUNDARY
DOWNSTREAM MODEL BOUNDARY
0 250 500 1000
SCALE IN FEET
LEGEND
PcR2 CONTROL MONUMENT
RIVER CENTERLINE
WATER LINE
EXTENT OF MUDFLATS DURING EBB TIDE
UNNAMED3 COMBINED SEWER OUTFALL (LOCATION APPROXIMATE)
MILE 1 DENOTES DISTANCE IN MILES ABOVE DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
50+00 STATION DESIGNATION ABOVE (RELATIVE) DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
NOTES:
1. ADD 4000' TO STATIONING TO OBTAIN STATIONING UTILIZED BY USACE IN FLOOD TUNNEL HYDROLOGIC/HYDRAULIC ANALYSES.
2. SOURCE: TOPO-METRICS 1"=100' ORIGINAL MYLAR POSITIVES OF AERIAL PHOTOMETRIC SURVEY (1982).
SECOND RIVER
PASSAIC RIVER
INDEX MAP
Job No. : 23508-T102A
Prepared by : K.A.P.
Date : 5/11/94
POINT NO POINT REACH
PASSAIC RIVER STUDY AREA
NEW JERSEY



NOTES:

1. ADD 4000' TO STATIONING TO OBTAIN STATIONING UTILIZED BY USACE IN FLOOD TUNNEL HYDROLOGIC/HYDRAULIC ANALYSES.
2. SOURCE: TOPO-METRICS 1"=100' ORIGINAL MYLAR POSITIVES OF AERIAL PHOTOMETRIC SURVEY (1982).

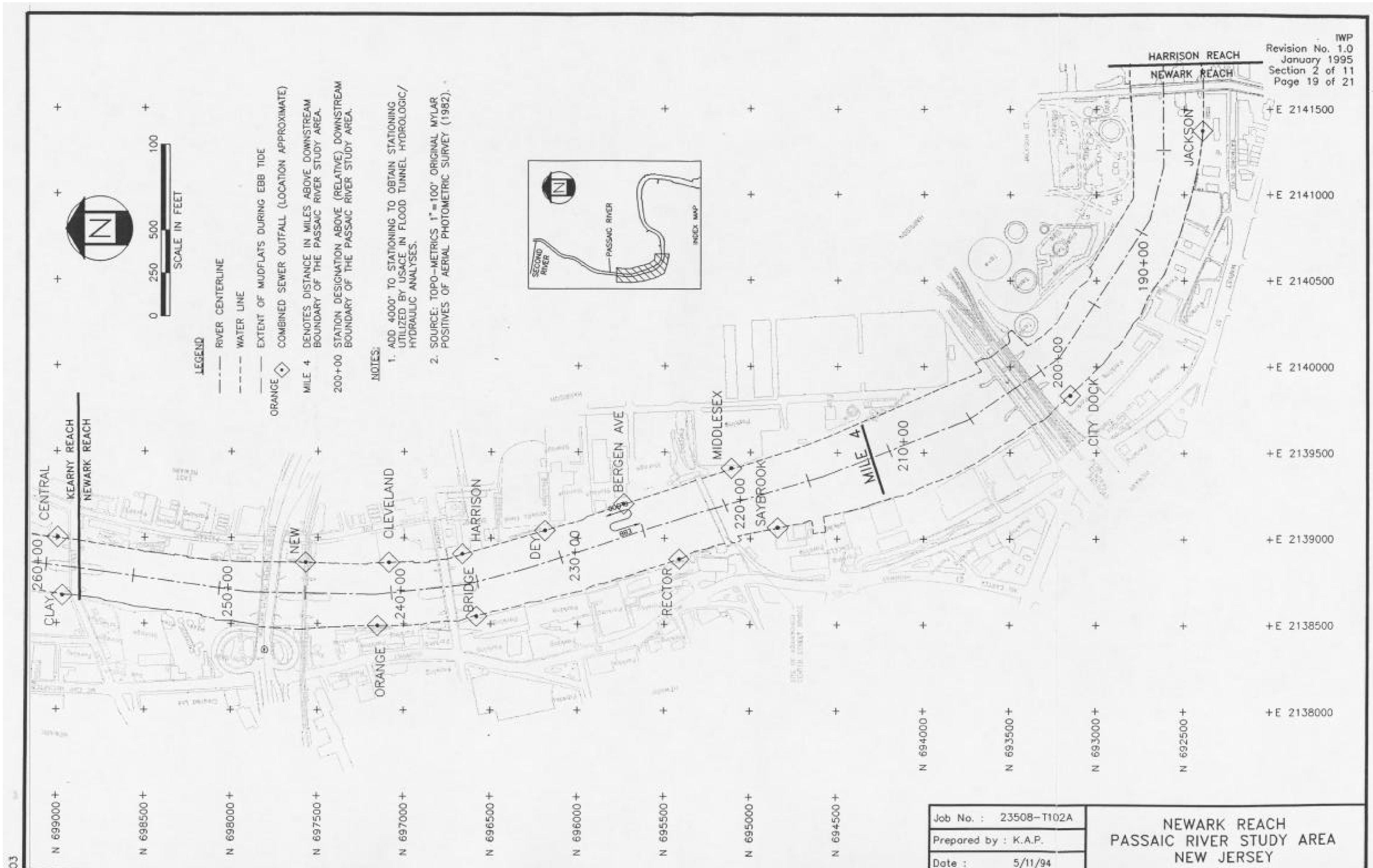
LEGEND

PcR7 CONTROL MONUMENT
RIVER CENTERLINE
WATER LINE
EXTENT OF MUDFLATS DURING EBB TIDE
NEWARK COMBINED SEWER OUTFALL (LOCATION APPROXIMATE)
MILE 3 DENOTES DISTANCE IN MILES ABOVE DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
80+00 STATION DESIGNATION ABOVE (RELATIVE) DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.

Job No. : 23508-T102A	HARRISON REACH PASSAIC RIVER STUDY AREA NEW JERSEY
Prepared by : K.A.P.	
Date : 5/11/94	

R02

FIG. 2-4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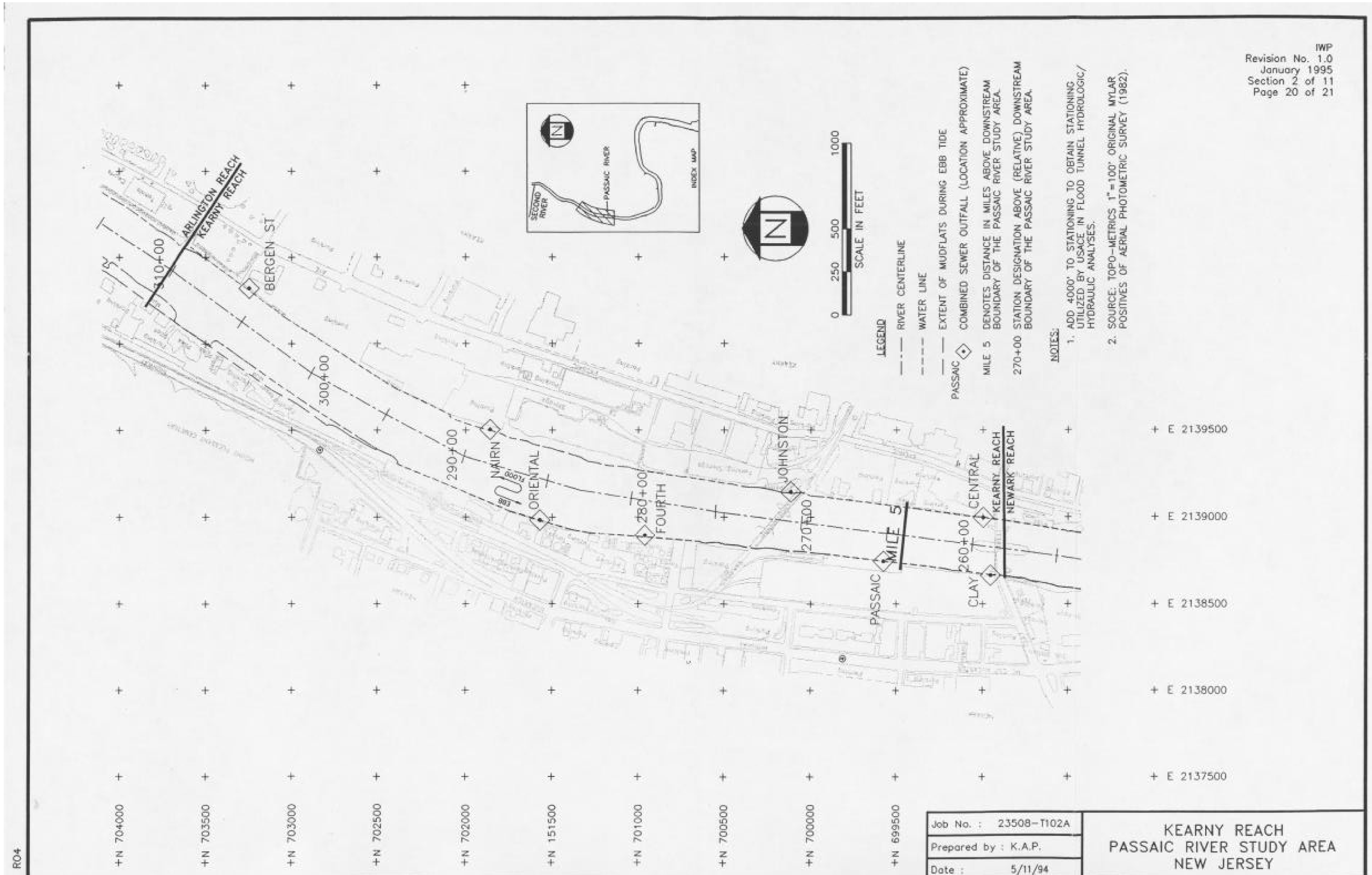
HARRISON REACH
NEWARK REACH
KEARNY REACH
SCALE IN FEET
0 250 500 100
LEGEND
RIVER CENTERLINE
WATER LINE
EXTENT OF MUDFLATS DURING EBB TIDE
ORANGE COMBINED SEWER OUTFALL (LOCATION APPROXIMATE)
MILE 4 DENOTES DISTANCE IN MILES ABOVE DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
200+00 STATION DESIGNATION ABOVE (RELATIVE) DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
NOTES:
1. ADD 4000' TO STATIONING TO OBTAIN STATIONING UTILIZED BY USACE IN FLOOD TUNNEL HYDROLOGIC/HYDRAULIC ANALYSES.
2. SOURCE: TOPO-METRICS 1"=100' ORIGINAL MYLAR POSITIVES OF AERIAL PHOTOMETRIC SURVEY (1982).
INDEX MAP
SECOND RIVER
PASSAIC RIVER
CENTRAL
CLAY
NEW
CLEVELAND
ORANGE
HARRISON
BRIDGE
DEY
BERGEN AVE
RECTOR
MIDDLESEX
SAYBROOK
MILE 4
CITY DOCK
JACKSON
260+00
250+00
240+00
230+00
220+00
210+00
200+00
190+00
E 2141500
E 2141000
E 2140500
E 2140000
E 2139500
E 2139000
E 2138500
E 2138000
N 699000
N 698500
N 698000
N 697500
N 697000
N 696500
N 696000
N 695500
N 695000
N 694500
N 694000
N 693500
N 693000
N 692500
Job No. : 23508-T102A
Prepared by : K.A.P.
Date : 5/11/94
NEWARK REACH
PASSAIC RIVER STUDY AREA
NEW JERSEY
R03

FIG. 2-5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LEGEND
RIVER CENTERLINE
WATER LINE
EXTENT OF MUDFLATS DURING EBB TIDE
PASSAIC COMBINED SEWER OUTFALL (LOCATION APPROXIMATE)
MILE 5 DENOTES DISTANCE IN MILES ABOVE DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
270+00 STATION DESIGNATION ABOVE (RELATIVE) DOWNSTREAM BOUNDARY OF THE PASSAIC RIVER STUDY AREA.
NOTES:
1. ADD 4000' TO STATIONING TO OBTAIN STATIONING UTILIZED BY USACE IN FLOOD TUNNEL HYDROLOGIC/HYDRAULIC ANALYSES.
2. SOURCE: TOPO-METRICS 1"=100' ORIGINAL MYLAR POSITIVES OF AERIAL PHOTOMETRIC SURVEY (1982).
0 250 500 1000
SCALE IN FEET
SECOND RIVER
PASSAIC RIVER
INDEX MAP
ARLINGTON REACH
KEARNY REACH
NEWARK REACH
310+00
300+00
290+00
280+00
270+00
260+00
BERGEN ST
NAIRN
ORIENTAL
FOURTH
JOHNSTON
PASSAIC
MILE 5
CENTRAL
CLAY
E 2139500
E 2139000
E 2138500
E 2138000
E 2137500
N 704000
N 703500
N 703000
N 702500
N 702000
N 151500
N 701000
N 700500
N 700000
N 699500
R04
Job No. : 23508-T102A
Prepared by : K.A.P.
Date : 5/11/94
KEARNY REACH
PASSAIC RIVER STUDY AREA
NEW JERSEY

FIG. 2-6

This document was developed as part of the conduct of a Remedial Investigation/Feasibility Study in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan to investigate the nature and extent of contamination in sediments in the Six Mile Passaic River Study Area, NJ, including historical and on-going sources. These documents have been developed in cooperation with, and were approved under, CERCLA by U.S. EPA Region 2. The reader is cautioned to carefully consider the specialized goals and objectives of these investigations, and to review all related documents.

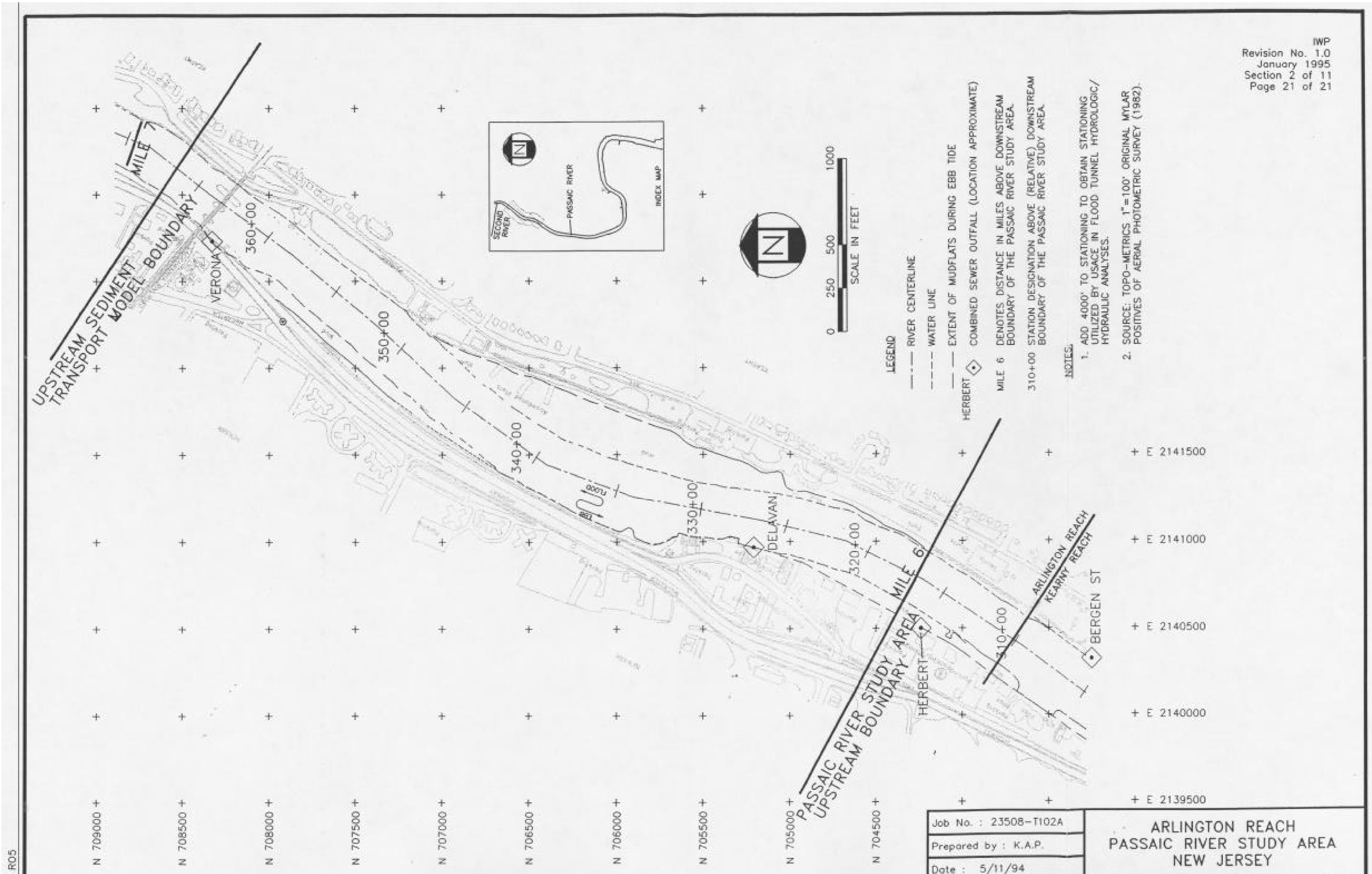

FIG. 2-7

The format of this document may appear slightly different from the version submitted to US EPA (1995) due to changes in software. There has been no change in content.